

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Alan J. HEEGER et al.
Title: REAGENTLESS, REUSABLE,
BIOELECTRONIC DETECTORS AND THEIR
USE AS AUTHENTICATION DEVICES
Appl. No.: 10/810,333
Filing Date: 3/25/2004
Examiner: Robert Thomas Crow
Art Unit: 1634
Confirmation Number: 8242
Number:

FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT
UNDER 37 CFR §1.56

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith on Form PTO/SB/08 is a listing of documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR §1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR §1.97 and §1.98. Document A1 listed on the attached Form PTO/SB/08, was cited as being relevant during the prosecution of the corresponding International Application, PCT/US04/09327. A copy of the International Search Report is attached setting forth the portion of the document considered relevant by the examiner.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present

application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

The listed documents are being submitted in compliance with 37 CFR §1.97(c), before the mailing date of either a final action under 37 CFR §1.113, a notice of allowance under 37 CFR §1.311, or an action that otherwise closes prosecution in the application.

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Fees in the amount of \$180.00 in accordance with 37 CFR §1.17(p) to cover the fee associated with an information disclosure statement under 37 CFR §1.97(c) are being paid by credit card via EFS-Web.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 50-0872. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-0872.

Respectfully submitted,

Date 25 January 2007

By Karen E. Flick

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STATEMENT BY APPLICANT**Date Submitted: 25 January 2007
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Sheet 1 of 3

Complete If Known

Application Number	10/810,333
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First Named Inventor	Alan J. HEEGER
Art Unit	1634
Examiner Name	Robert Thomas Crow
Attorney Docket Number	327823-1052

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
A	6,221,586 B1		04-24-2001	Barton et al.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No. ¹	U.S. Patent Application Document	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Serial Number-Kind Code ² (if known)			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ "Number" Kind Code ⁴ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁵

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
	C24	Bock et al. "Selection of single-stranded DNA molecules that bind and inhibit human thrombin" <i>Nature</i> 355:564-566 (1992)	
	C25	Bowell, D.D.L. "Options available from start to finish for obtaining expression data by microarray" <i>Nat. Genet.</i> 21:25-32 (1999)	
	C26	Brazili et al. "Sinusoidal voltammetry: a frequency based electrochemical detection technique" <i>J. Electroanal Chem.</i> 531:119-132 (2002)	
	C27	Buljsman et al. "Design and Synthesis of a Possible Mimic of a Thrombin-Binding DNA Aptamer" <i>Bioorg. & Med. Chem. Lett.</i> 7(15):2027-2032 (1997)	
	C28	Cheng et al. "Chip PCR. II. Investigation of different PCR amplification systems in microfabricated silicon-glass chips" <i>Nuc. Acid. Res.</i> 24(2):380-385 (1996)	
	C29	Cheng et al. "Preparation and hybridization analysis of DNA/RNA from <i>E. coli</i> on microfabricated bioelectronic chips" <i>Nat. Biotech.</i> 16:541-546 (1998)	

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Attorney Docket Number	327823-1052

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	C30	Cox et al. "Automated Acquisition of Aptamer Sequences" <i>Comb. Chem. & High Throughput Screening</i> 5:289-299 (2002)	
	C31	Diltmier et al. "A DNA-Based Machine That Can Cyclically Bind and Release Thrombin" <i>Agnew. Chem. Int. Ed.</i> 43:3550-3553 (2004)	
	C32	Ellington et al. "In vitro selection of RNA molecules that bind specific ligands" <i>Nature</i> 346:818-822 (1990)	
	C33	Fan et al. "Electrochemical interrogation of conformational changes as a reagentless method for the sequence-specific detection of DNA" <i>Proc. Natl. Acad. Sci. USA</i> 100(18):9134-9137 (2003)	
	C34	Fang et al. "Molecular Beacons" <i>Cell. Biochem. Biophys.</i> 37:71-81 (2002)	
	C35	Feng et al. "Synthetic DNA Aptamers to Detect Protein Molecular Variants in a High-Throughput Fluorescence Quenching Assay" <i>Chem. Bio. Chem.</i> 4:829-834 (2003)	
	C36	Fukushio et al. "In vitro selection and evaluation of ma aptamers that recognize arginine-rich-motif model peptide on a quartz-crystal microbalance" <i>Chem. Commun.</i> 1:88-89 (2002)	
	C37	Hamauchi et al. "Aptamer Beacons for the Direct Detection of Proteins" <i>Anal. Biochem.</i> 294:128-131 (2001)	
	C38	Heme et al. "Characterization of DNA Probes Immobilized on Gold Surfaces" <i>J. Am. Chem. Soc.</i> 119:8918-8920 (1997)	
	C39	Hianik et al. "Detection of aptamer-protein interactions using QCM and electrochemical indicator methods" <i>Bioorg. & Med. Chem. Lett.</i> 15:291-295 (2005)	
	C40	Hianik et al. "The study of the binding of globular proteins to DNA using mass detection and electrochemical indicator methods" <i>J. Electroanal. Chem.</i> 564:19-24 (2004)	
	C41	Ho et al. "Optical Sensors Based on Hybrid Aptamer/Conjugated Polymer Complexes" <i>J. Am. Chem. Soc.</i> 126:1384-1387 (2004)	
	C42	Iqbal et al. "A review of molecular recognition technologies for detection of biological threat agents" <i>Biosens. & Bioelectron.</i> 15:549-578 (2000)	
	C43	Kankia et al. "Folding of the Thrombin Aptamer into a G-Quadruplex with Sr ²⁺ : Stability, Heat, and Hydration" <i>J. Am. Chem. Soc.</i> 123:10799-10804 (2001)	
	C44	Lee et al. "A Fiber-Optic Microarray Biosensor Using Aptamers as Receptors" <i>Anal. Biochem.</i> 282:142-148 (2000)	
	C45	Leopold et al. "Influence of Gold Topography on Carboxylic Acid Terminated Self-Assembled Monolayers" <i>Langmuir</i> 18:978-980 (2002)	
	C46	Li et al. "Molecular Aptamer Beacons for Real-Time Protein Recognition" <i>Biochem. & Biophys. Res. Commun.</i> 292:31-40 (2002)	
	C47	Li et al. "Real-time Protein Monitoring Based on Molecular Beacons" <i>Curr. Proteomics</i> 1:315-324 (2004)	
	C48	Liss et al. "An Aptamer-Based Quartz Crystal Protein Biosensor" <i>Anal. Chem.</i> 74(17):4488-4495 (2002)	
	C49	Macaya et al. "Thrombin-binding DNA aptamer forms a unimolecular quadruplex structure in solution" <i>Proc. Natl. Acad. Sci. USA</i> 90:3745-3749 (1993)	

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	C50	Minnunni et al. "Development of biosensors with aptamers as bio-recognition element: the case of HIV-1 Tat protein" <i>Biosens. & Bioelectron.</i> 20:1149-1156 (2004)	
	C51	O'Connor et al. "A Nemstian electro source model for the ac voltammetric response of a reversible surface redox reaction using large-amplitude ac voltages" <i>J. Electroanal. Chem.</i> 466:197-202 (1999)	
	C52	Padmanabhan et al. "The Structure of α -Thrombin Inhibited by a 15-Mer Single-stranded DNA Aptamer" <i>Bio. Chem.</i> 268(24):17651-17654 (1993)	
	C53	Pavlov et al. "Aptamer-Functionalized Au Nanoparticles for the Amplified Optical Detection of Thrombin" <i>J. Am. Chem. Soc.</i> 126:11768-11769 (2004)	
	C54	Rajendran et al. "In vitro selection of molecular beacons" <i>Nucleic Acids. Res.</i> 31(19):5700-5713 (2003)	
	C55	Robertson et al. "Selection in vitro of an RNA enzyme that specifically cleaves single-stranded DNA" <i>Nature</i> 344:467-469 (1990)	
	C56	Savren et al. "Micromechanical Detection of Proteins Using Aptamer-Based Receptor Molecules" <i>Anal. Chem.</i> 76:3194-3198 (2004)	
	C57	Smimov et al. "Effect of Loop Sequence and Size on DNA Aptamer Stability" <i>Biochemistry</i> 39:1462-1468 (2000)	
	C58	Stojanovic et al. "Aptamer-Based Folding Fluorescent Sensor for Cocaine" <i>J. Am. Chem. Soc.</i> 123:4928-4931 (2001)	
	C59	Tan et al. "Molecular beacons" <i>Curr. Opin. Chem. Biol.</i> 8:547-553 (2004)	
	C60	Tombelli et al. "New Trends in Nucleic Acids Based Biosensors" <i>Anal. Lett.</i> 37(6):1037-1052 (2004)	
	C61	Wang et al. "A DNA Aptamer Which Binds to and Inhibits Thrombin Exhibits a New Structural Motif for DNA" <i>Biochemistry</i> 32:1899-1904 (1993)	
	C62	Willmar, Ilamar "Biomaterials for Sensors, Fuel Cells, and Circuitry" <i>Science</i> 298:2407-2408 (2002)	
	C63	Winzeler et al. "Fluorescence-Based Expression Monitoring Using Microarrays" <i>Methods Enzymol.</i> 306:3-18 (1999)	
	C64	Yamamoto et al. "Molecular beacon aptamer fluoresces in the presence of Tat protein of HIV-1" <i>Genes Cells</i> 5:389-396 (2000)	

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